Lassonde School of Engineering
Department of Earth and Space Science and Engineering
Geomatics Engineering

LE/ESSE 4650 – Hydrography
Winter 2022

LAB # 4: Processing of Multi Beam Echo-Sounding Data (100)
Part A: Data import and Project creation

Assigned: **March 4, 2022**
Due: **March 15, 2022**

Objective:
The objective of this lab is to acquaint students with processing of data from a multibeam echosounder using the CARIS HIPS and SIPS application software.

The processing of multi beam data will be performed in three parts.

Part A: Data import and Project Creation
Part B: Generation of Georeferenced Bathymetry
Part C: Generation and Export of Bathymetric Products

This lab covers Part A: Data import and Project creation.

Data and associated information:

You are provided with the following dataset:
- *Teledyne RESON SeaBat 7125, Multibeam Sonar, 512 beams.*
- *Vessel: FA_2807_Reson7125*
- *Date Collected: March 31, 2011 and April 01, 2011 (JD 2011-090 and 2011-091).*

Preprocess and Background data (Relevant Ancillary Data)

i. **Raw Data files for Conversion – Hypack Data** (*.RAW or *.HSX)
ii. **Background -** (*.KAP and *.000)
iii. **Applanix Ancillary Data**
- **Delayed Heave:** *2011_090_2807.000 and 2011_091_2807.000*
- **Navigation =** *2011_090_2807.sbet and 2011_091_2807.sbet*
- **Real Time Uncertainty data =** *2011_090_2807.smrmsg and 2011_091_2807.smrmsg*
- **SVP data** = *H12281_2807.svp*
- **Tide data:** *Seattle_9447130_20110318_20110502.tid*

Rawness of data

- Data are roll-compensated only, but not corrected for any other vessel motion.
- Offsets for navigation lever arms are compensated for in the POS/MV.
- Travel time and angle information is available.

Positioning information

- Data in geographic coordinates.
- **CRS** Pick **NAD83 / UTM zone 10N EPSG:26910**

IMPORTANT NOTE: The license for using the provided CARIS software and the provided datasets are only for the purpose of this lab assignment. Do not use or distribute any of the software, data or any related information outside this course.

SUBMISSION OF LAB TECHNICAL REPORT AND REQUIREMENTS:

1. Submit a detailed report to demonstrate and explain your understanding of the steps involved in data import and project creatin for the echosounding data. Additionally, you may utilize screenshots to show your results.

2. Provide a workflow chart of the steps undertaken.

3. Throughout this document, there are several requirements for lab submission. These are highlighted in **red** under the heading '**SUBMIT'**. Ensure these are requirements are also met and submitted along with your lab report.

Part A: Data Import and Project creation consists of the following steps:

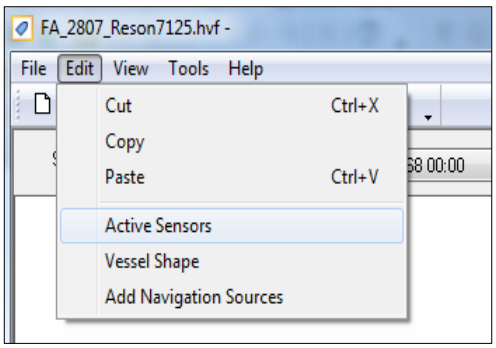
1. **Create a Vessel File**: Setup the sensor locations and uncertainties in the vessel reference frame.
2. **Create a New HIPS File**: Setup the HIPS Data Source.
3. **Import Sensor Data**: Import raw data into HIPS data format.
4. **Background data**: Load the Background data files: **US5WA14M.000, 18374_1.KAP**
5. **Import Auxiliary Data:** Import extra post-processed data, like Delayed Heave, post processed Navigation and Motion, and Real Time (RMS) Uncertainty data.
6. **Save Project**: Save the current workspace (data and current view)

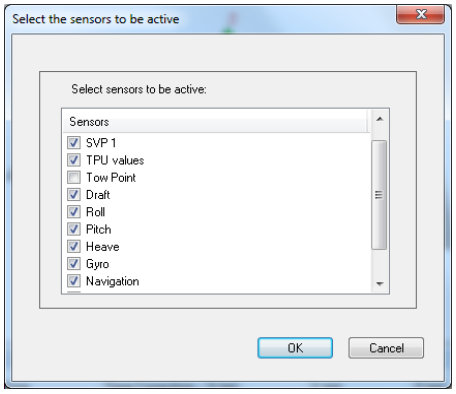
Task A1: Create a Vessel File from Data

- Create and configure the shape of a new vessel file (follow the steps in MB manual Pages 66-70).

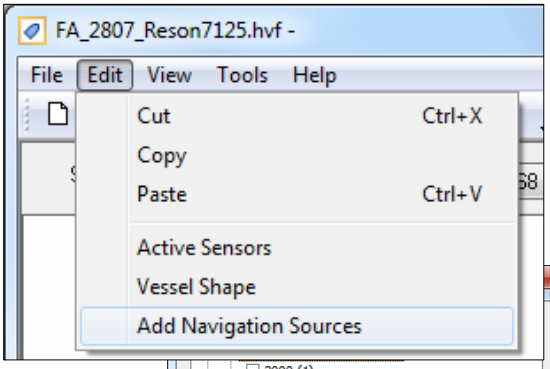
- Setup the active sensors with their associated offsets, calibration and timestamps in the vessel reference frame (follow pages 71-73).

1. To set active sensors to be active: Edit >> Active Sensors: Check all sensors except ***the Tow point and Transducer 2.***

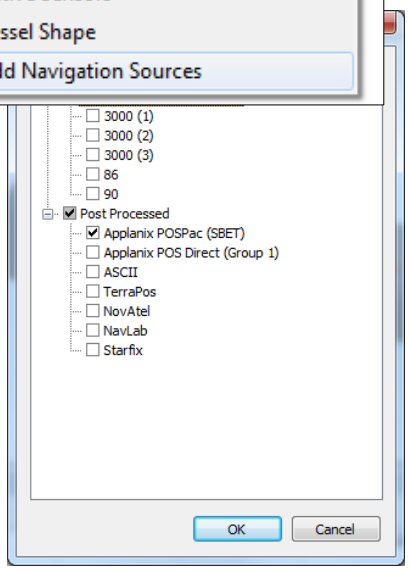




2. Select Edit >> Add Navigation Sources



3. Select **Post- Processed >> Applanix POSPac (SBET):**
   To add Navigation and attitude data (SBET) data to apply corrections to the survey lines, after raw data conversion.



4. Save your Vessel file in the **VesselConfig** folder.
5. Click on File>>Exit.

- Add the sensor offsets and navigation sources as described in the HIPs multibeam manual pages 74-75 and save the vessel file as **myVessel** in **VesselConfig** folder.

Sensor Offsets

- Transducer 1: dX = 0.019, dY = 0.244, dZ = 0.481, Roll = 0.0º, Pitch = 0.0 º and Yaw = 0.0 º
- Navigation: Time Error = 0.0, dX = 0.00, dY = 0.00 and dZ = 0.00, Ellipsoid=NA83
- Gyro: 0.00
- Heave and Pitch: dX= 0.00, dY= 0.00, dZ = 0.00, Apply=Yes

- Roll: Apply=No
- Draft: Apply=Yes, Table included
- SVP 1: X = 0.019, Y = 0.244, Z = 0.481, Roll = -1.49º, Pitch = 0.100º and Yaw = 0.500º
- Waterline Height: Waterline = -0.090, Apply=Yes

Note: The offsets are zeros for the Navigation and the Motion (Heave) sensors because all of the lever arms for the antenna position and IMU position were accounted for, in the Applanix POS/MV unit (GNSS/IMU) onboard the vessel.

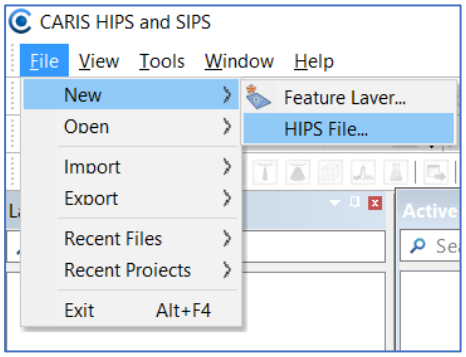
Dynamic Draft: Enter values given in Exercise 23 (page 76)

Sound Velocity Values: For converting travel time and angle information into across-track and depth values (page 77)

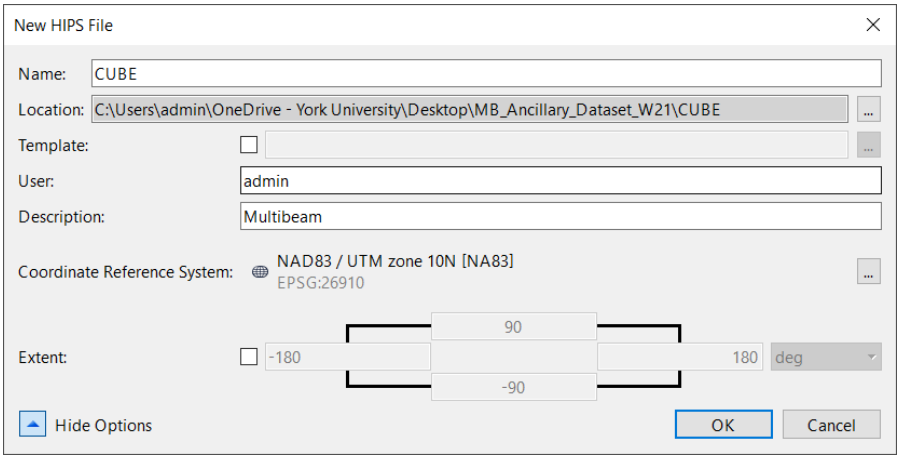
Deliverable A1 (15): Verify that the vessel file has been created and stored. Generate the graphic to visualize your vessel showing the location of the Reference Point (RP), the location of all sensors relative to RP and verification of the correct application of the offsets. Comment on the alignment of the sensors with respect to the vessel's axes.

Task A2: Create the HIPS Project file

1. Chose File >> New >> HIPs File
2. Name new HIPs file as CUBE



3. Save in the same folder as your Multibeam data.



4. On Description, type MultiBeam and chose the Co-ordinate Reference System **NAD83 / UTM zone 10N EPSG:26910**
5. Then Click OK.

Deliverable A2 (10): Provide the output window showing the creation of the HIPS file (start and end date and time).

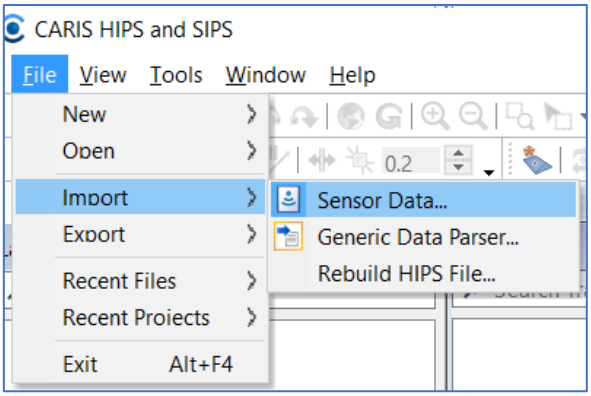
Task A3: Import Sensor Data or Add Raw data Hypack files (*.HSX)

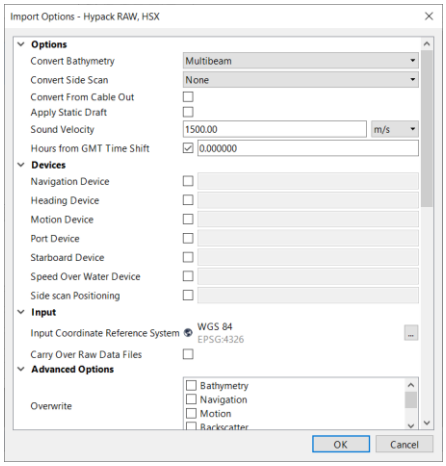
Sample Data Set

- Teledyne RESON 7125, Multibeam Sonar, 512 beams.
- Vessel: FA_2807_Reson7125
- Multibeam Sensor set-up date: March 09, 2011 (Julian Date 2011-068)
- Date Collected: March 31, 2011 and April 01, 2011 (Julian Dates 2011-090 and 2011-091).
- Raw data in HSX format

Import Sensor Data icon or select File > Import > Sensor Data **File > Open >> … Preprocess \ CUBE\ Hypack\H12281\ FA_2807_RESON7125** from the menu.

Follow the steps in MB manual Pages 85-88 to add the Hypack raw data, HIPs file (CUBE.hips) and Vessel File (FA_2807_RESON7125).





Deliverable A3 (10): How many survey lines have been successfully read on the two Julian Dates?

Deliverable A4 (10): Show that the HIPS file has been created and opened in the main HIPS and SIPS interface with track lines. Provide screen caption.

Deliverable A5 (10): What's the cross line that appears in your track lines display.

Deliverable A6 (10): Use the display extent to determine the geographical coverage of the area.

Task A4: Loading the Background data layers (*. KAP and *.000)

Follow the steps in the MB Manual pages **28-30.**

i. **File>> Open** >> Browse to the directory **…\...\Background\CUBE** and select the file **18474_1.KAP.**
In the properties window, set the **transparency to 50**, click on Refresh to view the track lines.

ii. **File>> Open** >> Browse to the directory **…\...\Background\CUBE** and select the **US5WA14M.000** click **Open**. Check the **S-57 Update Option** message and Begin the processing at **1** and click **OK.**

Deliverable A7 (10): How many and which layers were added.

Deliverable A8 (15): Ensure both survey lines and background data layers are visible and provide a screen snapshot of your map.

Task A5: Import Auxiliary Data

Follow the steps in pages 90 – 94 and import the extra post-processed data, like **Delayed Heave**, **post processed Navigation and Attitude**, and **Real Time Uncertainty data** (RMS values)

i. To import delayed heave (Pages 90 -91, Exercise 29)
File > Import > Auxiliary Data > Applanix POS MV\ DelayedHeave\2807 and select the files **2011_090_2807.000** and **2011_091_2807.000**

ii. To import HIPS from Applanix SBET (Smoothed Best Estimate of Trajectory) (Pages 92 -93, Exercise 30)

File > Import > Auxiliary Data > Applanix SBET\Applanix\SBET\2807 and select the files **2011_090_2807.sbet** and **2011_091_2807.sbet**

iii. To Import Real Time Uncertainty Data - Applanix RMS (Pages 94-95, Exercise 31)
File > Import > Auxiliary Data > Applanix RMS \Applanix\ RMS\2807 and select the files **2011_090_2807.smrmsg and 2011_091_2807.smrmsg.**

Deliverable A9 (10): Why are the Real Time Uncertainty data required? (2)
Provide a screen caption of the Selection window to show all the survey lines and that all the data have been imported properly. (2)

Task A6: Save Project

Save the project (*.project) in the same directory. File >> Save as >> filename.project.